Docket No. 50-346
License No. NPF-3
Serial No. 1387
Enclosure
Page 1

APPLICATION FOR AMENDMENT

TO

FACILITY OPERATING LICENSE NO. NPF-3

FOR

DAVIS-BESSE NUCLEAR POWER STATION

UNIT NO. 1

Attached are requested changes to the Davis-Besse Nuclear Power Station, Unit No. 1, Facility Operating License No. NPF-3. Also included are the Safety Evaluation and Significant Hazards Consideration.

The proposed changes (submitted under cover letter Serial No. 1387) concern:

Section 3/4.3.2, Safety System Instrumentation, Table 3.3-5, Safety Features System Response Times;
Section 3/4.3.2, Safety System Instrumentation, Specification 3.3.2.2, Table 3.3-13, Steam and Feedwater Rupture Control System Response Times;
Section 3/4.6.3, Containment Isolation Valves, Table 3.6-2, Containment Isolation Valves; and
Section 3/4.7.1, Turbine Cycle, Specification 4.7.1.5, Main Steam Line Isolation Valves.

By ______________________
D. C. Shelton, Vice President, Nuclear

Sworn to and subscribed before me this 27th day of July, 1987.

Patricia L. Fussler
Notary Public, State of Ohio

My commission expires 5/18/91

8708050247 870727
PDR ADOCK 05000346
P PDR

Docket No. 50-346
License No. NPF-3
Serial No. 1387

The following information is provided to support issuance of the requested changes to the Davis-Besse Nuclear Power Station, Unit No. 1 Operating License No. NPF-3, Appendix A, Technical Specifications: Section 3/4.3.2, Table 3.3-5; Section 3/4.3.2, Table 3.3-13; Section 3/4.6.3, Table 3.6-2; and Section 3/4.7.1, Specification 4.7.1.5.

A. Time required to implement: This change is to be effective 30 days after issuance of the License Amendment.

B. Reason for change (Facility Change Request No. 87-0032, Revision A): Revise the Technical Specifications to make the MSIV closure time requirements consistent throughout the Technical Specifications under the assumptions made in analyses contained in the Updated Safety Analysis Report (USAR). The changes also eliminate unnecessary Technical Specification requirements not needed to satisfy the assumptions made in the USAR.

C. Safety Evaluation: See attached Safety Evaluation (Attachment 1).

D. Significant Hazards Consideration: See attached Significant Hazards Consideration (Attachment 2).

SAFETY EVALUATION

INTRODUCTION

The purpose of this safety evaluation is to review proposed changes to the Davis-Besse Nuclear Power Station (DBNPS), Unit No. 1 Operating License, Appendix A (Technical Specifications), as described in FCR 87-0032, Revision A: Main Steam Isolation Valve (MSIV) Closure Time Technical Specification Revision. This safety evaluation is being performed to meet the requirements of 10CFR50.59 to ensure no unreviewed safety questions exist with the proposed changes.

The MSIVs are installed in the two main steam lines between the steam generators (SGs) and the turbine to provide isolation of the SGs. Automatic closure of the MSIVs is initiated by either the Safety Features Actuation System (SFAS) upon a high-high containment pressure or by the Steam and Feedwater Rupture Control System (SFRCS). SFRCS initiates closure of the MSIV following either a low pressure in a steam line, a high differential pressure between the SG and the main feedwater line, or a high level in a SG. Upon detection of a steam line low pressure, MSIV closure isolates the SG from any piping faults, maintains it as a heat sink, and also isolates the steam lines as part of the containment integrity. In this latter case, the main steam lines, along with the feedwater lines are considered Type III containment penetrations since they are not a part of the reactor coolant pressure boundary (Type I) and are not connected directly to the containment vessel atmosphere (Type II). The MSIVs can also be closed by manual push button from the control room.

Operability and closure time requirements for the MSIVs are identified in four different sections of the Davis-Besse Technical Specifications as noted below:

Section 3.3.2.1 (Safety Features Actuation System Instrumentation), Table 3.3-5 (page 3/4 3-18) requires that the response time for the MSIVs be less than or equal to 10 seconds. The bases for this Technical Specification state that this response time is commensurate with the time limit assumed in the safety analyses.

Section 3.3.2.2 (Steam and Feedwater Rupture Control System Instrumentation), Table 3.3-13 (page 3/4 3-29) requires an isolation time of less than or equal to 6 seconds for the MSIVs. The bases for this section are the same as those noted above for Section 3.3.2.1 (Safety Features Actuation System Instrumentation).

Section 3.6.3.1 (Containment Isolation Valves), Table 3.6-2 (page 3/4 6-17) requires an isolation time of less than or equal to 5 seconds for these valves. The bases for this section state that containment isolation with the time limits specified ensures that the release of radioactive material to the environment will be consistent with the assumptions used in the analyses for a Loss of Coolant Accident (LOCA).

Finally, Section 3/4.7.1.5 (Main Steam Line Isolation Valves), page 3/4 7-9, requires full closure of the MSIVs within 5 seconds. According to the bases for this section, this requirement ensures that no more than one SG will blow down in the event of a steam line rupture. This is required to 1) minimize the positive reactivity effects of the Reactor Coolant System cooldown associated with the blowdown and 2) limit the pressure rise within the containment if the rupture occurs within the containment. The bases further state that the closure time requirement is consistent with the assumptions used in the safety analyses.

The analyses in the Final Safety Analysis Report/Updated Safety Analysis Report (FSAR/USAR) have assumed different MSIV closure times. The Main Steam Line Break (MSLB) analysis (USAR Section 15.4.4) assumed a one second SFRCS response time and a five second MSIV stroke time. The feedwater line rupture analysis (USAR Section 15.2.8) assumed a five second closure time. The containment isolation analysis assumed that containment integrity requirements are established prior to the peak containment temperature and pressure occurring following the largest credible pipe break inside containment. USAR Table 6-8 shows a 10 second time for the Main Steam Line, but a footnote adds "the response time for the main steam isolation valve is 5 seconds and for the main steam isolation valve bypass valve (normally closed) is 10 seconds..." Hence, it is not explicit what the valve's stroke time needs to be in order to meet the design requirements of the FSAR/USAR analyses.

To eliminate the conflicting requirements identified in these documents, this Safety Evaluation proposes to change the four Technical Specifications as summarized below:

Table 3.3-5 Safety Features System Response Times, Item 3.c.1: The Main Steam Line Isolation Valve response time is to be changed from less than or equal to 10 seconds to "not applicable" (N/A).

Table 3.6-2 Containment Isolation Valves, Section A: Penetration Number 39, MS-100 and Penetration 40, MS-101 are to be changed from 5 seconds to "not applicable" (N/A).

Table 3.3-13 Steam and Feedwater Rupture Control System (SFRCS) Response Times, Item 2, Main Steam Isolation Valves: To be changed from less than or equal to 6 seconds to less than or equal to 6.0 seconds for the Main Steam line low pressure channels of SFRCS and less than or equal to 6.5 seconds for the Steam Generator/Main Feedwater high reverse differential pressure channels of SFRCS. Additionally, a footnote is to be added to explicitly define what is to be included in those time requirements.

Section 3/4.7.1.5, Technical Specification Surveillance Requirement 4.7.1.5 is to be revised to refer to the requirements of Technical Specification Table 3.3-13 when the MSIVs are tested pursuant to meeting ASME Section XI code requirements.

Each of the proposed changes will be fully explained and justified in following sections of this evaluation.

The primary purpose for making the proposed Technical Specification changes is to provide explicit, consistent closure time requirements where needed to meet the assumptions made in analyses contained in the USAR regarding MSIV closure time. Secondly, the proposed Technical Specification changes eliminate requirements where they are not needed to satisfy the assumptions made in the USAR, while still ensuring complete compliance with the requirements of 10CFR50, Appendix A, General Design Criteria for Nuclear Power Plants.

SYSTEMS AFFECTED

Main Steam (MS) System
Containment System
Reactor Core/Reactor Coolant System (RCS)
Steam and Feedwater Rupture Control System (SFRCS)
Safety Features Actuation System (SFAS)

REFERENCES

1. Davis-Besse Nuclear Power Station, Unit No. 1, Updated Safety Analysis Report, June, 1986;

2. Davis-Besse Nuclear Power Station, Unit No. 1, Operating License, Appendix A, Technical Specifications;

3. Babcock and Wilcox Document 51-1167928-00, MSIV Closure Time Evaluation for DB-1, January 18, 1987;

4. SFRCS Response Time Following a Feedwater Line Break, Davis-Besse Calculation C-NSA-083.03-001, Revision 0.

FUNCTIONS OF AFFECTED SYSTEMS

The Main Steam System is used to remove heat generated by the reactor and the reactor coolant pumps primarily during power operations by converting water entering the secondary side of the SGs to steam and then piping the steam to the Main Turbine, the Main Feedwater Pump Turbines, and several other loads. With the exception of the Auxiliary Feedwater Pump Turbines, the Main Steam Safety Valves, and the Atmospheric Vent Valves, steam can be prevented from leaving a SG by closing the Main Steam Isolation Valve, which is located outside containment in the main steam piping. The closure of both valves will isolate any steam line breaks which may occur downstream of them.

Should a steam line break occur upstream of a MSIV, the SG supplying that line will completely blowdown its inventory out of the break because this break cannot be isolated. Closure of the opposite MSIV will terminate the blowdown of the unaffected SGs inventory out of the break. Similarly, a feedwater line rupture downstream of the Main Feedwater Isolation Valves will cause one SG to empty. Closure of the unaffected SG's MSIV will terminate blowdown of inventory from the unaffected SG, which is occurring due to it being interconnected to the faulted SG through the equalizing section of the turbine chest. In this manner the MSIVs function to limit blowdown of SGs following a Main Steam or Main Feedwater System pipe rupture.

The Containment System is designed to withstand the worst Design Basis Accident (DBA) postulated for the Davis-Besse plant, in order to limit the consequences to the public of such accidents. For breaks in the Reactor Coolant System (LOCAs), the containment accomplishes this function by establishing predetermined levels of leak tight integrity.

The containment structure has also been analyzed to ensure that it can withstand the effects of a MSLB or Main Feedwater line rupture within it. As demonstrated in USAR Section 6.2, the pressurization consequences of these accidents, which include the complete blowdown of the faulted SG, and partial blowdown (until it is isolated) of the unaffected SG, are less severe than the worst case LOCA pressure transient. As analyzed in USAR Section 15.4.4, a MSLB will cause a higher peak containment temperature than a LOCA, but due to the short duration of these higher temperatures and the thermal inertia of the containment and equipment inside it, the consequences of the MSLB temperature transient are less severe than that due to a LOCA. The radiological consequences of a LOCA are much more severe than that due to a MSLB or a Main Feedwater line rupture as established in USAR Sections 15.4.6, 15.4.4, and 15.2.8. The function of the containment is to establish and maintain designated levels of leak tight integrity following high energy line faults occurring within the containment.

The reactor core adds thermal energy to the Reactor Coolant System (RCS) through the fission and radioactive decay processes. This energy is then transferred to the Main Feedwater in the SG, where it becomes main steam. The steam is then transported to the turbine generator, where it is converted to electrical energy. Control of the core's thermal energy output is maintained by controlling the reactivity balance of the core. Due to the design of the core, the temperature of the RCS affects the core's reactivity balance. A RCS temperature decrease causes the amount of reactivity to increase due to the moderator temperature and fuel doppler effects. A large amount of negative reactivity is inserted in the core (through the use of the control rods and possible addition of borated water) to quickly reduce fission produced energy following a LOCA, a MSLB, or a feedwater line rupture. However, due to the blowdown of secondary SG inventory during a steam line break or a feedwater line break, the RCS may cool down, depending on the break size, location, and decay heat levels. The negative reactivity inserted in the core must completely offset the positive reactivity added due to the cooldown to ensure that the only energy which must be removed from the core is generated by radioactive decay processes. Although not considered to be a concern for Davis-Besse, such consequences are evaluated below.

The SFRCS is a system designed to detect and mitigate the effects of major Main Steam/Main Feedwater System upsets including MSLBs, Main Feedwater line ruptures, loss of Main Feedwater accidents, SG overfeeding events, and a loss of RCS forced circulation flow. The SFRCS performs its design functions by automatically positioning valves and initiating Auxiliary Feedwater (AFW) to the SGs, as required. The system detects a MSLB by sensing a main steam line low pressure condition in the faulted SG's steam line; and it responds primarily by isolating both SGs, including closing the main feedwater isolation valves and the MSIVs, along with the Turbine Stop Valves. It also starts the AFW Pumps and aligns both pumps to the unaffected SG. The system senses a feedwater line rupture by detecting a steam line low pressure on the faulted SG or a high reverse differential pressure between the unaffected SG and its feedwater line. Either of these conditions will cause the unaffected SG to be isolated from the break. A SG overfill event will also cause MSIV closure; however, a delayed MSIV closure time has no significant safety consequences for this event, since MSIV closure occurs only to prevent water droplet impingement damage to non-safety related balance of plant equipment such as the Main Turbine. A loss of Main Feedwater event and a loss of all RCS forced circulation event do not affect MSIV position. In summary, for this safety evaluation's stated purpose, the function of SFRCS is to sense a MSLB or Main Feedwater line rupture and to isolate the unaffected SG to limit its loss of inventory, to limit both the reactivity addition to the RCS and the environmental consequences caused inside containment, and to initiate AFW.

The SFAS senses adverse containment conditions which indicates a LOCA may have occurred. Based on predetermined severity levels, the SFAS, among other actions, automatically establishes containment leaktight integrity by performing its containment isolation function. A design basis LOCA will cause essentially complete containment isolation, including closing the MSIVs. A SFAS Level 4 condition, which is created by a high-high containment pressure, is the containment isolation level which causes MSIV closure. Such a condition only occurs during a large break LOCA. A MSLB will not cause this level of containment isolation.

EFFECTS ON SAFETY

The effects of changes to the MSIV response time requirements on plant safety, which the proposed Technical Specification changes could allow, must be evaluated in the following areas:

a. Containment Isolation

b Main Steam Line Breaks

c. Main Feedwater Line Breaks

Each area must be reviewed to ensure there are no adverse effects due to the SG inventory blowdown, or the potential for release of radioactive contamination to the environment, the potential for core recriticality, the environmental consequences, and the Auxiliary Feedwater Pump operability.

Containment Isolation

Technical Specification 3/4.3.2, Table 3.3-5 "Safety Features System Response Times" requires that the Main Steam Isolation Valves (MSIVs) be able to close within 10 seconds of an isolation signal being generated. This isolation signal is generated by high-high containment pressure (set at 38.4 psia). This is the required TOTAL response time of the Safety Features Actuation System (SFAS) and the valve closure time. The basis of this requirement, as stated in the bases section of the Technical Specifications is: "The OPERABILITY of these systems is required to provide the overall reliability, redundancy, and diversity assumed available in the facility design for the protection and mit gation of accident and transient conditions. The integrated operation of each of these systems is consistent with the assumptions used in the accident analyses."

Technical Specification 3/4.6.3.3, Table 3.6-2, "Containment Isolation Valves", requires that the MSIVs close in 5 seconds to accomplish containment isolation. The basis for this in the Technical Specifications is: "The OPERABILITY of the containment isolation valves ensures that the containment atmosphere will be isolated from the outside environment in the event of a release of radioactive material to the containment atmosphere or pressurization of the containment. Containment isolation within the tim limits specified ensures that the release of radioactive material to the environment will be consistent with the assumptions used in the analyses for a LOCA."

Containment isolation is not impacted by the proposed changes to the closure time requirements for the MSIVs. The Main Steam Lines are "Type III" penetrations, in that they (as well as the secondary side of the SGs) do not directly connect to the containment atmosphere. Therefore, for large break LOCAs, the closure of the MSIVs serves only to back up the integrity of the RCS pressure boundary and does not affect off-site radiological doses. It is to be noted that SFRCS provides automatic closure of the MSIVs following a LOCA whenever SG secondary side pressure falls below 600 psig. This results in the present SFAS signal being redundant to the existing SFRCS low pressure signal. This redundant signal, however, is not required for the successful mitigation of either a main steam line break or a LOCA. Additionally, prior to SFRCS isolation, no flow path exists between the containment or RCS and the environment following a large break LOCA due to the SG secondary side pressure exceeding 600 psig. Consequently, the time response of the MSIVs is not of safety significance as long as closure does occur so that the SG tube integrity is backed up for reliability.

In this way, the requirements of General Design Criterion 57 are met. Consequently, the proposed Technical Specifications which delete any specific time requirement for the MSIV closure for SFAS and containment isolation are acceptable.

Main Steam Line Break

USAR, Section 15.4.4, has assumed that following a MSLB, the unaffected SG is isolated within 6.0 seconds of a Low Main Steam Line Pressure condition occurring. It is also shown that the 36 inch MSLB is the most limiting size break. The proposed changes to the Technical Specifications still explicitly require that the 6.0 second SG isolation time be met, but no one specific component response time is required, unlike the present Technical Specifications. With this approach, the MSIVs and SFRCS will still have a demonstrated capability to satisfy the assumptions made in the USAR Chapter 15 accident analyses. Consequently, the proposed Technical Specification changes have no impact on MSLB accidents. The changes clarify what is included in the overall 6.0 second response time for a low pressure trip which is indicative of a MSLB.

Main Feedwater Line Break

USAR Section 15.2.8 investigates feedwater line break analyses as a potential loss of feedwater event. The USAR analyses assume a MSIV closure time of 5 seconds following detection of an SFRCS reverse differential pressure signal. Consequently, with the proposed change in the SFRCS response time requirement to 6.5 seconds for reverse differential pressure, it is necessary to assess the impact of an additional 1.5 second closure time for the MSIV following a feedwater line break.

The feedwater line break represents a USAR Chapter 15 event that is dominated by the response of the secondary plant; however, it is an event that does not place any requirements on the MSIVs. The closure time used does not impact the safety consequences associated with this event. The feedwater line break event isolates the Main Steam System, however, the isolation of the feedwater system is the important factor for this event. The mass and energy releases from a feedwater line break are also lower than for a steam line break or a LOCA, since lower temperature fluid is exiting the break.

Based upon a review of the SG inventory shown in USAR Figure 15.2.8-3, it is concluded that the increase in blowdown from the unaffected SG due to an additional 1.5 seconds would not impact the loss of feedwater results contained in Chapter 15. Additionally, this extra mass and energy would not affect the design basis containment vessel environmental conditions since the feedwater line break transient results are bounded by steam line breaks and LOCA events, as analyzed in Reference 4.

MSIV Mechanical Operability

One further consideration must be reviewed in finding a 6.0 second SFRCS/MSIV closure response time acceptable. The MSIVs are included in the ASME Code Section XI program, and have a "limiting value" stroke time of 5 seconds. The basis of this time is the Technical Specifications, which are based on accident analyses. It has been evaluated that an overall MSIV response time of 6.0 seconds is acceptable from an accident analyses standpoint, and the valve manufacturer has concurred that the valve still has acceptable mechanical operability with up to a 6.0 second stroke time. Consequently, the proposed Technical Specification changes do not affect the MSIV mechanical operability requirements.

UNREVIEWED SAFETY QUESTION EVALUATION

The increased closure time of the MSIV from 5.0 seconds to a total SFRCS response time of within 6.0 seconds for a Low Steam Line Pressure condition (or 6.5 seconds for a high reverse differential pressure condition) will not increase the probability of occurrence of any previously analyzed accident because there are no physical changes being made to the plant so that the same equipment will be operated and tested in the same manner as before. This evaluation demonstrates that the consequences of that operation and testing to different standards are acceptable. Consequently, the proposed Technical Specification changes will not increase the probability of occurrence of any previously analyzed accident (10CFR50.59(a)(2)(i)).

Any delayed closure of the MSIVs, as long as the appropriate SG(s) is (are) isolated within 6.0 seconds for a Low Steam Line Pressure condition (or within 6.5 seconds for a high reverse differential pressure condition), will not increase the consequences of any event previously analyzed in the USAR. While the delay may affect the plant response during a feedwater line break, it has been demonstrated that the consequences of those changes are acceptable so that all design criteria are met, resulting in no change in the consequences of the event. The proposed Technical Specification changes will not increase the consequences of any event previously analyzed in the USAR since the consequences stay within the limits defined in the bases of the Technical Specifications (10CFR50.59(a)(2)(i)).

Any delayed MSIV closure, as long as the appropriate SG(s) is (are) isolated within 6.0 seconds for a Low Steam Line Pressure condition (or within 6.5 seconds for a high reverse differential pressure condition), will not increase the probability of occurrence of a malfunction of equipment important to safety previously evaluated in the USAR. While the delay does impact the environmental response of containment during a main feedwater line break, it has been demonstrated that the currently used containment temperature and pressure profiles provide sufficient margin so that the delay does not invalidate the qualification status of any previously qualified equipment. The delayed closure has no other impact on equipment important to safety. The proposed Technical Specification changes will not increase the probability of occurrence of a malfunction of equipment important to safety previously evaluated in the USAR, since the time requirements have been demonstrated to be acceptable and the testing methods to verify compliance will not be affected by the changes (10CFR50.59(a)(2)(i)).

Any delayed MSIV closure, as long as the appropriate SG(s) is (are) isolated within 6.0 seconds for a Steam Line Low Pressure condition (6.5 seconds for a high reverse differential pressure condition), will not increase the consequences of a malfunction of equipment important to safety previously evaluated in the USAR, since all previously analyzed events, with appropriate failure included are still valid. This is because the plant will still be operated and tested in the same way as previously done. The proposed Technical Specification changes will not increase the consequences of a malfunction of equipment important to safety previously evaluated in the USAR since the plant will continue to be operated within the design bases of the USAR, which has included the effects of failure of equipment important to safety (10CFR50.59(a)(2)(i)).

Any delayed MSIV closure, as long as the appropriate SG(s) is (are) isolated within 6.0 seconds for a Low Steam Line Pressure condition (6.5 seconds for a high reverse differential pressure condition) does not create the possibility for an accident of a different type than any previously evaluated in the USAR. This is because all the equipment will be functioning the same as before, and all methods of operation and testing will be the same as before. The proposed Technical Specification changes do not create the possibility of an accident of a different type than previously evaluated in the USAR, since all equipment will be functioning the same, and all methods of operation and testing will be the same as before (10CFR50.59(a)(2)(ii)).

Any delayed MSIV closure, as long as the appropriate SG(s) is (are) isolated within 6.0 seconds for a Low Steam Line Pressure condition (6.5 seconds for a high reverse differential pressure condition) does not create the possibility for a malfunction of a different type than any evaluated previously in the USAR, since all equipment will be operated and tested as before, and the change does not subject any equipment conditions which are different than previously analyzed so that the same failure modes and mechanisms exist as before. The proposed Technical Specification changes do not create the possibility for a malfunction of a different type than any previously evaluated in the USAR. This is because all equipment is being operated and tested as before, with only the Surveillance Requirement acceptance criteria being changed. Since no new methods of operation or testing are being introduced, no different malfunctions other than those previously evaluated are introduced (10CFR50.59(a)(2)(ii)).

Any delayed MSIV closure, as long as the appropriate SG(s) is (are) isolated within 6.0 seconds following a Low Steam Line Pressure condition (6.5 seconds following a high reverse differential pressure condition), does not reduce the margin of safety as defined in the bases for any Technical Specifications. While the change does decrease the margins available and the margin from initiating an SFAS Level 4 signal for a Main Feedwater line break, sufficient margin exists to absorb these changes without any change in the consequences, so that all design criteria which form the bases of the Technical Specifications are met. Therefore, no reduction in the margin of safety results. The proposed Technical Specification changes do not reduce the margin of safety as defined in the bases for any Technical Specification since they do not invalidate any of the analyses presented in the USAR which provided the technical background for the bases presented in the Technical Specifications. The same design criteria are met for all analyses in the USAR so that no reduction in the margin of safety occurs (10CFR50.59(a)(2)(iii)).

CONCLUSION

It has been determined that, a MSIV closure time of 6.0 seconds following a MSLB break is the most limiting time requirement for the MSIV closure time. By meeting this response time, which includes the time from when the Main Steam Line Low Pressure condition is created at the Main Steam Line Pressure Sensors until the MSIVs are fully closed will provide protection against the effects of a MSLB inside containment. A 6.5 second response time, from the time a high reverse differential pressure condition is created, until the MSIVs are closed will provide protection against the effects of a feedwater line break inside containment. As previously discussed, no specific SFAS closure time is required, as long as functional operability is verified.

Based on the above discussion, it is concluded that the proposed Technical Specification changes do not constitute an unreviewed safety question.

SIGNIFICANT HAZARDS CONSIDERATION

INTRODUCTION

The purpose of this evaluation is to review proposed changes to the Davis-Besse Nuclear Power Station (DBNPS), Unit No. 1 Operating License, Appendix A (Technical Specifications), as described in FCR 87-0032, Revision A: Main Steam Isolation Valve (MSIV) Closure Time Technical Specification Revision. This evaluation is being performed to meet the requirements of 10CFR50.92 to ensure no significant hazards exist with the proposed changes.

The MSIVs are installed in the two main steam lines between the steam generators (SGs) and the turbine to provide isolation of the SGs. Automatic closure of the MSIVs is initiated by either the Safety Features Actuation System (SFAS) upon a high-high containment pressure or by the Steam and Feedwater Rupture Control System (SFRCS). SFRCS initiates closure of the MSIV following either a low pressure in a steam line, a high differential pressure between the SG and the main feedwater line, or a high level in a SG. Upon detection of a steam line low pressure, MSIV closure isolates the SG from any piping faults, maintains it as a heat sink, and also isolates the steam lines as part of the containment integrity. In this latter case, the main steam lines, along with the feedwater lines are considered Type III containment penetrations since they are not a part of the reactor coolant pressure boundary (Type I) and are not connected directly to the containment vessel atmosphere (Type II). The MSIVs can also be closed by manual push button from the control room.

Operability and closure time requirements for the MSIVs are identified in four different sections of the Davis-Besse Technical Specifications as noted below:

Section 3.3.2.1 (Safety Features Actuation System Instrumentation), Table 3.3-5 (page 3/4 3-18) requires that the response time for the MSIVs be less than or equal to 10 seconds. The bases for this Technical Specification state that this response time is commensurate with the time limit assumed in the safety analyses.

Section 3.3.2.2 (Steam and Feedwater Rupture Control System Instrumentation), Table 3.3-13 (page 3/4 3-29) requires an isolation time of less than or equal to 6 seconds for the MSIVs. The bases for this section are the same as those noted above for Section 3.3.2.1 (Safety Features Actuation System Instrumentation).

Section 3.6.3.1 (Containment Isolation Valves), Table 3.6-2 (page 3/4 6-17) requires an isolation time of less than or equal to 5 seconds for these valves. The bases for this section state that containment isolation with the time limits specified ensures that the release of radioactive material to the environment will be consistent with the assumptions used in the analyses for a Loss of Coolant Accident (LOCA).

Finally, Section 3/4.7.1.5 (Main Steam Line Isolation Valves), page 3/4 7-9, requires full closure of the MSIVs within 5 seconds. According to the bases for this section, this requirement ensures that no more than one SG will blow down in the event of a steam line rupture. This is required to 1) minimize the positive reactivity effects of the Reactor Coolant System cooldown associated with the blowdown and 2) limit the pressure rise within the containment if the rupture occurs within the containment. The bases further state that the closure time requirement is consistent with the assumptions used in the safety analyses.

The analyses in the Final Safety Analysis Report/Updated Safety Analysis Report (FSAR/USAR) have assumed different MSIV closure times. The Main Steam Line Break (MSLB) analysis (USAR Section 15.4.4) assumed a one second SFRCS response time and a five second MSIV stroke time. The feedwater line rupture analysis (USAR Section 15.2.8) assumed a five second closure time. The containment isolation analysis assumed that containment integrity requirements are established prior to the peak containment temperature and pressure occurring following the largest credible pipe break inside containment. USAR Table 6-8 shows a 10 second time for the Main Steam Line, but a footnote adds "the response time for the main steam isolation valve is 5 seconds and for the main steam isolation valve bypass valve (normally closed) is 10 seconds..." Hence, it is not explicit what the valve's stroke time needs to be in order to meet the design requirements of the FSAR/USAR analyses.

To eliminate the conflicting requirements identified in these documents, this Safety Evaluation proposes to change the four Technical Specifications as summarized below:

Table 3.3-5	Safety Features System Response Times, Item 3.c.1,: The Main Steam Line Isolation Valve response time is to be changed from less than or equal to 10 seconds to "not applicable" (N/A).
Table 3.6-2	Containment Isolation Valves, Section A: Penetration Number 39, MS-100 and Penetration 40, MS-101 are to be changed from 5 seconds to "not applicable" (N/A).
Table 3.3-13	Steam and Feedwater Rupture Control System (SFRCS) Response Times, Item 2, Main Steam Isolation Valves: To be changed from less than or equal to 6 seconds to less than or equal to 6.0 seconds for the Main Steam line low pressure channels of SFRCS and less than or equal to 6.5 seconds for the Steam Generator/Main Feedwater high reverse differential pressure channels of SFRCS. Additionally, a footnote is to be added to explicitly define what is to be included in those time requirements.

Section 3/4.7.1.5, Technical Specification Surveillance Requirement 4.7.1.5 is to be revised to refer to the requirements of Technical Specification Table 3.3-13 when the MSIVs are tested pursuant to meeting ASME Section XI code requirements.

Each of the proposed changes will be fully explained and justified in following sections of this evaluation.

The primary purpose for making the proposed Technical Specification changes is to provide explicit, consistent closure time requirements where needed to meet the assumptions made in analyses contained in the USAR regarding MSIV closure time. Secondly, the proposed Technical Specification changes eliminate requirements where they are not needed to satisfy the assumptions made in the USAR, while still ensuring complete compliance with the requirements of 10CFR50, Appendix A, General Design Criteria for Nuclear Power Plants.

SYSTEMS AFFECTED

Main Steam (MS) System
Containment System
Reactor Core/Reactor Coolant System (RCS)
Steam and Feedwater Rupture Control System (SFRCS)
Safety Features Actuation System (SFAS)

REFERENCES

1. Davis-Besse Nuclear Power Station, Unit No. 1, Updated Safety Analysis Report, June, 1986;

2. Davis-Besse Nuclear Power Station, Unit No. 1, Operating License, Appendix A, Technical Specifications;

3. Babcock and Wilcox Document 51-1167928-00, MSIV Closure Time Evaluation for DB-1, January 18, 1987;

4. SFRCS Response Time Following a Feedwater Line Break, Davis-Besse Calculation C-NSA-083.03-001, Revision 0.

FUNCTIONS OF AFFECTED SYSTEMS

The Main Steam System is used to remove heat generated by the reactor and the reactor coolant pumps primarily during power operations by converting water entering the secondary side of the SGs to steam and then piping the steam to the Main Turbine, the Main Feedwater Pump Turbines, and several other loads. With the exception of the Auxiliary Feedwater Pump Turbines, the Main Steam Safety Valves, and the Atmospheric Vent Valves, steam can be prevented from leaving a SG by closing the Main Steam Isolation Valve (MSIV), which is located outside containment in the main steam piping. The closure of both valves will isolate any steam line breaks which may occur downstream of them.

Should a steam line break occur upstream of a MSIV, the SG supplying that line will completely blowdown its inventory out of the break because this break cannot be isolated. Closure of the opposite MSIV will terminate the blowdown of the unaffected SGs inventory out of the break. Similarly, a feedwater line rupture downstream of the Main Feedwater Isolation Valves will cause one SG to empty. Closure of the unaffected SG's MSIV will terminate blowdown of inventory from the unaffected SG, which is occurring due to it being interconnected to the faulted SG through the equalizing section of the turbine chest. In this manner the MSIVs function to limit blowdown of SGs following a Main Steam or Main Feedwater System pipe rupture.

The Containment System is designed to withstand the worst Design Basis Accident (DBA) postulated for the Davis-Besse plant, in order to limit the consequences to the public of such accidents. For breaks in the Reactor Coolant System (LOCAs), the containment accomplishes this function by establishing predetermined levels of leak tight integrity.

The containment structure has also been analyzed to ensure that it can withstand the effects of a MSLB or Main Feedwater line rupture within it. As demonstrated in USAR Section 6.2, the pressurization consequences of these accidents, which include the complete blowdown of the faulted SG, and partial blowdown (until it is isolated) of the unaffected SG, are less severe than the worst case LOCA pressure transient. As analyzed in USAR Section 15.4.4, a MSLB will cause a higher peak containment temperature than a LOCA, but due to the short duration of these higher temperatures and the thermal inertia of the containment and equipment inside it, the consequences of the MSLB temperature transient are less severe than that due to a LOCA. The radiological consequences of a LOCA are much more severe than that due to a MSLB or a Main Feedwater line rupture as established in USAR Sections 15.4.6, 15.4.4, and 15.2.8. The function of the containment is to establish and maintain designated levels of leak tight integrity following high energy line faults occurring within the containment.

The reactor core adds thermal energy to the Reactor Coolant System (RCS) through the fission and radioactive decay processes. This energy is then transferred to the Main Feedwater in the SG, where it becomes main steam. The steam is then transported to the turbine generator, where it is converted to electrical energy. Control of the core's thermal energy output is maintained by controlling the reactivity balance of the core. Due to the design of the core, the temperature of the RCS affects the core's reactivity balance. A RCS temperature decrease causes the amount of reactivity to increase due to the moderator temperature and fuel doppler effects. A large amount of negative reactivity is inserted in the core (through the use of the control rods and possible addition of borated water) to quickly reduce fission produced energy following a LOCA, a MSLB, or a feedwater line rupture. However, due to the blowdown of secondary SG inventory during a steam line break or a feedwater line break, the RCS may cool down, depending on the break size, location, and decay heat levels. The negative reactivity inserted in the core must completely offset the positive reactivity added due to the cooldown to ensure that the only energy which must be removed from the core is generated by radioactive decay processes. Although not considered to be a concern for Davis-Besse, such consequences are evaluated below.

The SFRCS is a system designed to detect and mitigate the effects of major Main Steam/Main Feedwater System upsets including MSLBs, Main Feedwater line ruptures, loss of Main Feedwater accidents, SG overfeeding events, and a loss of RCS forced circulation flow. The SFRCS performs its design functions by automatically positioning valves and initiating Auxiliary Feedwater (AFW) to the SGs, as required. The system detects a MSLB by sensing a main steam line low pressure condition in the faulted SG's steam line; and it responds primarily by isolating both SGs, including closing the main feedwater isolation valves and the MSIVs, along with the Turbine Stop Valves. It also starts the AFW Pumps and aligns both pumps to the unaffected SG. The system senses a feedwater line rupture by detecting a steam line low pressure on the faulted SG or a high reverse differential pressure between the unaffected SG and its feedwater line. Either of these conditions will cause the unaffected SG to be isolated from the break. A SG overfill event will also cause MSIV closure; however, a delayed MSIV closure time has no significant safety consequences for this event, since MSIV closure occurs only to prevent water droplet impingement damage to non-safety related balance of plant equipment such as the Main Turbine. A loss of Main Feedwater event and a loss of all RCS forced circulation event do not affect MSIV position. In summary, for this safety evaluation's stated purpose, the function of SFRCS is to sense a MSLB or Main Feedwater line rupture and to isolate the unaffected SG to limit its loss of inventory, to limit both the reactivity addition to the RCS and the environmental consequences caused inside containment, and to initiate AFW.

The SFAS senses adverse containment conditions which indicates a LOCA may have occurred. Based on predetermined severity levels, the SFAS, among other actions, automatically establishes containment leaktight integrity by performing its containment isolation function. A design basis LOCA will cause essentially complete containment isolation, including closing the MSIVs. A SFAS Level 4 condition, which is created by a high-high containment pressure, is the containment isolation level which causes MSIV closure. Such a condition only occurs during a large break LOCA. A MSLB will not cause this level of containment isolation.

EFFECTS ON SAFETY

The effects of changes to the MSIV response time requirements on plant safety, which the proposed Technical Specification changes could allow, must be evaluated in the following areas:

a. Containment Isolation

b. Main Steam Line Breaks

c. Main Feedwater Line Breaks

Each area must be reviewed to ensure there are no adverse effects due to the SG inventory blowdown, or the potential for release of radioactive contamination to the environment, the potential for core recriticality, the environmental consequences, and the Auxiliary Feedwater Pump operability.

Containment Isolation

Technical Specification 3/4.3.2, Table 3.3-5 "Safety Features System Response Times" requires that the Main Steam Isolation Valves (MSIVs) be able to close within 10 seconds of an isolation signal being generated. This isolation signal is generated by high-high containment pressure (set at 38.4 psia). This is the required TOTAL response time of the Safety Features Actuation System (SFAS) and the valve closure time. The basis of this requirement, as stated in the bases section of the Technical Specifications is: "The OPERABILITY of these systems is required to provide the overall reliability, redundancy, and diversity assumed available in the facility design for the protection and mitigation of accident and transient conditions. The integrated operation of each of these systems is consistent with the assumptions used in the accident analyses."

Technical Specification 3/4.6.3.3, Table 3.6-2, "Containment Isolation Valves", requires that the MSIVs close in 5 seconds to accomplish containment isolation. The basis for this in the Technical Specifications is: "The OPERABILITY of the containment isolation valves ensures that the containment atmosphere will be isolated from the outside environment in the event of a release of radioactive material to the containment atmosphere or pressurization of the containment. Containment isolation within the time limits specified ensures that the release of radioactive material to the environment will be consistent with the assumptions used in the analyses for a LOCA."

Containment isolation is not impacted by the proposed changes to the closure time requirements for the MSIVs. The Main Steam Lines are "Type III" penetrations, in that they (as well as the secondary side of the SGs) do not directly connect to the containment atmosphere. Therefore, for large break LOCAs, the closure of the MSIVs serves only to back up the integrity of the RCS pressure boundary and does not affect off-site radiological doses. It is to be noted that SFRCS provides automatic closure of the MSIVs following a LOCA whenever SG secondary side pressure falls below 600 psig. This results in the present SFAS signal being redundant to the existing SFRCS low pressure signal. This redundant signal, however, is not required for the successful mitigation of either a main steam line break or a LOCA. Additionally, prior to SFRCS isolation, no flow path exists between the containment or RCS and the environment following a large break LOCA due to the SG secondary side pressure exceeding 600 psig. Consequently, the time response of the MSIVs is not of safety significance as long as closure does occur so that the SG tube integrity is backed up for reliability.

In this way, the requirements of General Design Criterion 57 are met. Consequently, the proposed Technical Specifications which delete any specific time requirement for the MSIV closure for SFAS and containment isolation are acceptable.

Main Steam Line Break

USAR, Section 15.4.4, has assumed that following a MSLB, the unaffected SG is isolated within 6.0 seconds of a Low Main Steam Line Pressure condition occurring. It is also shown that the 36 inch MSLB is the most limiting size break. The proposed changes to the Technical Specifications still explicitly require that the 6.0 second SG isolation time be met, but no one specific component response time is required, unlike the present Technical Specifications. With this approach, the MSIVs and SFRCS will still have a demonstrated capability to satisfy the assumptions made in the USAR Chapter 15 accident analyses. Consequently, the proposed Technical Specification changes have no impact on MSLB accidents. The changes clarify what is included in the overall 6.0 second response time for a low pressure trip which is indicative of a MSLB.

Main Feedwater Line Break

USAR Section 15.2.8 investigates feedwater line break analyses as a potential loss of feedwater event. The USAR analyses assume a MSIV closure time of 5 seconds following detection of an SFRCS reverse differential pressure signal. Consequently, with the proposed change in the SFRCS response time requirement to 6.5 seconds for reverse differential pressure, it is necessary to assess the impact of an additional 1.5 second closure time for the MSIV following a feedwater line break.

The feedwater line break represents a USAR Chapter 15 event that is dominated by the response of the secondary plant; however, it is an event that does not place any requirements on the MSIVs. The closure time used does not impact the safety consequences associated with this event. The feedwater line break event isolates the Main Steam System, however, the isolation of the feedwater system is the important factor for this event. The mass and energy releases from a feedwater line break are also lower than for a steam line break or a LOCA, since lower temperature fluid is exiting the break.

Based upon a review of the SG inventory shown in USAR Figure 15.2.8-3, it is concluded that the increase in blowdown from the unaffected SG due to an additional 1.5 seconds would not impact the loss of feedwater results contained in Chapter 15. Additionally, this extra mass and energy would not affect the design basis containment vessel environmental conditions since the feedwater line break transient results are bounded by steam line breaks and LOCA events, as analyzed in Reference 4.

MSIV Mechanical Operability

One further consideration must be reviewed in finding a 6.0 second SFRCS/MSIV closure response time acceptable. The MSIVs are included in the ASME Code Section XI program, and have a "limiting value" stroke time of 5 seconds. The basis of this time is the Technical Specifications, which are based on accident analyses. It has been evaluated that an overall MSIV response time of 6.0 seconds is acceptable from an accident analyses standpoint, and the valve manufacturer has concurred that the valve still has acceptable mechanical operability with up to a 6.0 second stroke time. Consequently, the proposed Technical Specification changes do not affect the MSIV mechanical operability requirements.

SIGNIFICANT HAZARDS CONSIDERATION

The proposed change does not involve a significant hazards consideration because the operation of the Davis-Besse Nuclear Power Station, Unit No. 1, in accordance with this change would not:

1. Involve a significant increase in the probability or consequences of an accident previously evaluated because the increased closure time of the MSIVs from 5.0 seconds to a total SFRCS response time of within 6.0 seconds for a Low Steam Line Pressure condition (or 6.5 seconds for a high reverse differential pressure condition) requires no physical changes to the plant so that the same equipment will be operated and tested in the same manner as before. In addition, this evaluation demonstrates the operation and testing to different standards are acceptable so that all design criteria are met (10CFR50.92(c)(1)).

2. Create the possibility of a new or different kind of accident from any accident previously evaluated because all the equipment will be functioning the same as before, and all methods of operation and testing will be the same as before (10CFR50.92(c)(2)).

3. Involve a significant reduction in a margin of safety because any delayed MSIV closure, as long as the appropriate SG(s) is (are) isolated within 6.0 seconds following a Low Steam Line Pressure condition (6.5 seconds following a high reverse differential pressure condition) does not invalidate any of the analysis presented in the USAR (10CFR50.92(c)(3)).

CONCLUSION

Based on the above discussion, Toledo Edison has determined that the Amendment Request does not involve a significant hazards consideration.